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## **Abstract**

The U.S. Department of Veterans Affairs compensates 13 percent of the nation's military veterans for service-related disabilities through the Disability Compensation (DC) program. In 2001, a legislative change made it easier for Vietnam veterans to receive benefits for diabetes associated with military service. In this paper, we investigate this policy's effect on DC enrollment and expenditures as well as the behavioral response of potential beneficiaries. Our findings demonstrate that the policy increased DC enrollment by 6 percentage points among Vietnam veterans and that an additional 1.7 percent experienced an increase in their DC benefits, which increased annual program expenditures by \$2.85 billion in 2007. Using individual-level data from the Veterans Supplement to the Current Population Survey, we find that the induced increase in DC enrollment had little average impact on the labor supply or health status of Vietnam veterans but did reduce labor supply among their spouses.

## **Disciplines**

Other Economics | Other Education | Political Economy

# Federal Policy and the Rise in Disability Enrollment: Evidence for the Veterans Affairs' Disability Compensation Program

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## Abstract

The U.S. Department of Veterans Affairs compensates 13 percent of the nation's military veterans for service-related disabilities through the Disability Compensation (DC) program. In 2001, a legislative change made it easier for Vietnam veterans to receive benefits for diabetes associated with military service. In this paper, we investigate this policy's effect on DC enrollment and expenditures as well as the behavioral response of potential beneficiaries. Our findings demonstrate that the policy increased DC enrollment by 6 percentage points among Vietnam veterans and that an additional 1.7 percent experienced an increase in their DC benefits, which increased annual program expenditures by \$2.85 billion in 2007. Using individual-level data from the Veterans Supplement to the Current Population Survey, we find that the induced increase in DC enrollment had little average impact on the labor supply or health status of Vietnam veterans but did reduce labor supply among their spouses.

## 1. Introduction

A large body of recent research measures the economic impact of public disability insurance programs resulting in large part from the rising fraction of nonelderly

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adults receiving disability benefits in the United States and other industrialized countries. These studies examine the causes for the rise in disability insurance receipt as well as the behavioral consequences of program enrollment. Previous studies of U.S. disability programs focus almost entirely on the two largest, Social Security Disability Insurance (SSDI) and Supplemental Security Income (SSI). Virtually no previous research has examined the Disability Compensation (DC) program, the nation's third largest disability program. The DC program, administered by the U.S. Department of Veterans Affairs (VA), provides \$31 billion per year in benefits to more than 3 million veterans and their families. In a review of disability insurance studies by Bound and Burkhauser (1999), 44 papers consider SSDI, and 17 consider SSI, while just one considers the DC program.<sup>1</sup>

In this paper, we aim to fill this gap in the literature by estimating how a little-noticed expansion of the DC program's medical eligibility criteria affected the program's enrollment and expenditures and how the resulting increase in DC enrollment affected the labor supply, health, and economic well-being of potential beneficiaries. Previous researchers have examined these issues for the SSDI and SSI programs (Parsons 1980; Bound 1989; Black, Daniel, and Sanders 2002; Autor and Duggan 2003; Chen and Van der Klaauw 2007) and for similar programs in other countries (Borsch-Supan 2000; Gruber 2000). However, because programs such as SSDI and SSI are federally administered with uniform eligibility criteria and benefit formulas nationwide, it has proven difficult to obtain an appropriate comparison group with which to estimate either the causes or the consequences of disability program enrollment.

To shed light on these issues for the VA's DC program, we focus on a recent change to the program's medical eligibility criteria that deemed type 2 diabetes associated with wartime exposure to herbicides a compensable disability for Vietnam veterans. Prior to this change, there was little to no medical evidence that credibly established an association between herbicide exposure and diabetes onset, so veterans seeking DC benefits for diabetes rarely satisfied the program's service-connectedness criterion. However, in October of 2000, the National Institute of Medicine (2000) issued a report that linked exposure to Agent Orange, an herbicide used by the U.S. military in Vietnam, to the onset of diabetes.

In response to the report, the VA defined diabetes as a presumptively service-connected disability for Vietnam veterans who served in the Vietnam theater,

<sup>1</sup> By the end of 2008, 7.43 million disabled adults were enrolled in Social Security Disability Insurance (SSDI), 5.18 million were enrolled in Supplemental Security Income (SSI; Social Security Administration 2010), and 2.94 million were enrolled in the Disability Compensation (DC) program (Veterans Benefits Administration 2008). The sole paper that considers the DC program, by Burkhauser and Daly (1999), compares the economic well-being of individuals who receive SSDI, SSI, DC, or workers' compensation benefits in the United States with those receiving disability benefits in Germany.

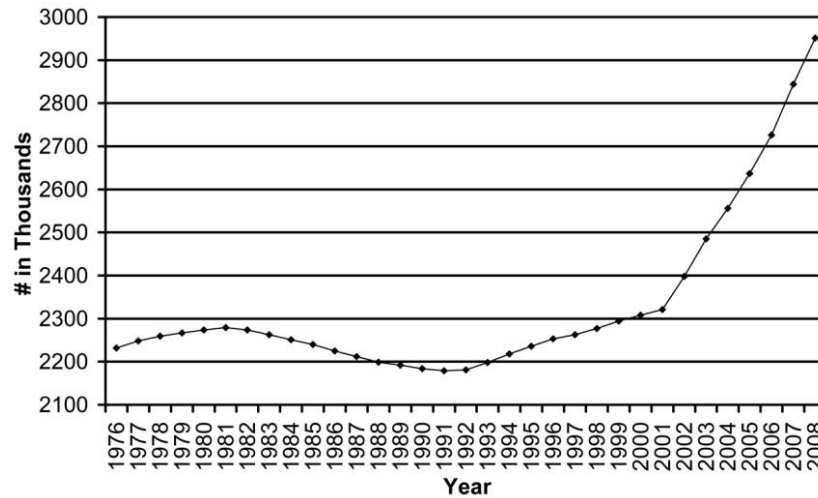


Figure 1. Number of recipients of disability compensation, 1976–2008

and this definition became effective in July 2001.<sup>2</sup> “Presumptively” meant that, to qualify for DC benefits, Vietnam veterans did not have to prove that they were exposed to Agent Orange during their military service or that herbicide exposure was the direct cause for their diabetes onset. Instead, service connectedness would be presumed based on dates and locations of service. The policy does not apply to veterans from other service eras or Vietnam-era veterans who did not serve in Vietnam, which allows us to use other veterans as a comparison group when estimating the effect of the program.

According to Figure 1, there was a significant acceleration in DC enrollment that coincided with the advent of the policy. From 1996 to 2001, the number of DC recipients increased by just .6 percent per year, but during the next 7 years, the annual growth rate was 3.5 percent. The timing of this growth in the DC rolls, immediately after enactment of the policy, suggests that the expansion of the eligibility criteria for Vietnam veterans was its main cause.

We first quantify the effect of the policy on DC enrollment and expenditures attributable to Vietnam veterans using administrative data. We employ a difference-in-differences identification strategy exploiting the fact that the policy applied only to Vietnam veterans. We use as our comparison group peacetime veterans, the vast majority of whom served shortly before or after the

<sup>2</sup> The legislative change applies equally to veterans who served in the Vietnam theater, defined as the ground in, the air above, and the waters surrounding Vietnam, Laos, and Cambodia. In this paper, we refer to all veterans affected by this policy as Vietnam veterans and to the Vietnam theater as Vietnam. “Vietnam-era veteran” refers to any veteran who served between 1964 and 1975, regardless of whether he or she served in the Vietnam theater.

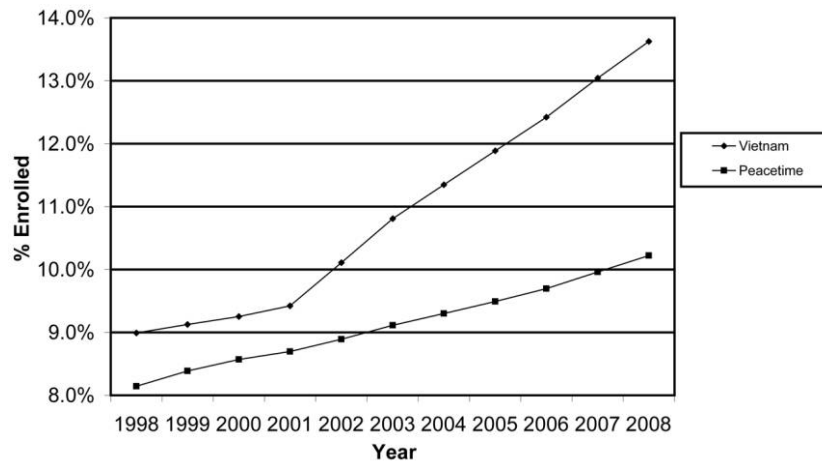


Figure 2. Disability compensation enrollment for Vietnam-era and peacetime veterans, 1998–2008.

Vietnam conflict. The key identifying assumption of our approach is that the change in DC enrollment and expenditures would have been the same for the two groups after 2001 in the absence of the policy change, which is supported by the similarity in their enrollment trends before the policy was implemented, as shown in Figure 2.

The results of our analyses suggest that the change to the DC program's eligibility criteria increased the number of Vietnam veterans in the program in September of 2008 by more than 200,000, which amounts to 3.2 percent of Vietnam-era veterans and 6.0 percent of those who served in or around Vietnam.<sup>3</sup> Our results further indicate that an additional 65,000 Vietnam veterans who were receiving DC benefits in the summer of 2001 qualified for an increase in their benefits because of the policy change. We use a similar methodology and the same treatment and comparison groups to investigate the effect of the change on program expenditures. Our estimates suggest that DC expenditures during the 2007 fiscal year were \$2.85 billion higher than they would have been without the legislative change, which implies an average increase of approximately \$1,000 per month in cash benefits per affected DC beneficiary.

Given the discrete change in medical eligibility criteria and the apparent rise in DC benefit receipt, we next estimate the impact of DC benefit generosity on the labor supply, health, and economic well-being of Vietnam veterans. We use several years of individual-level data from the biennial Veterans Supplement to

<sup>3</sup> According to the Current Population Survey (CPS) Veterans Supplement in 1997, 1999, and 2001, 47 percent of Vietnam-era veterans reported that they served in Vietnam, Cambodia, or Laos. The remaining 53 percent were unaffected by the policy.

the Current Population Survey (CPS), which, unlike the administrative data used in the enrollment and expenditure analysis, reports whether a Vietnam-era veteran actually served in or around Vietnam. This additional information not only allows for the identification of veterans directly affected by the policy but also allows for the identification of an arguably better comparison group than peacetime veterans: Vietnam-era veterans who did not serve in Vietnam. In comparison to peacetime veterans, the age distribution among Vietnam-era veterans who did not serve in Vietnam is more comparable to the age distribution among those who did.

Using the CPS data, we first confirm that DC benefit receipt accelerated among Vietnam veterans after the policy relative to Vietnam-era veterans who did not serve in or around Vietnam. We estimate that from 2001 to 2005 DC enrollment increased by 4 percentage points more among Vietnam veterans than among other veterans from the same service era. This estimated increase in DC enrollment is similar to the estimate derived from administrative data after adjusting for the different years used in the two analyses.

After confirming the rise in DC enrollment among Vietnam-era veterans after the policy's enactment, we estimate the impact of DC benefits on other outcomes of interest. First, our findings provide little evidence to suggest that the increase in disability benefit enrollment reduced the labor supply of affected Vietnam veterans, although the large standard errors of our estimates do not rule out a wide range of labor-supply effects. We do find some suggestive evidence that the wives of Vietnam veterans significantly reduced their labor supply in response to the policy change. This is consistent with findings from previous research that wealth effects through transfer income may not affect labor supply decisions of the recipient (Krueger and Pischke 1992) but may affect others in the same household (Cullen and Gruber 2000). And, finally, our results suggest little impact on the health of Vietnam veterans as measured by self-reported disability status, although we do find some evidence of an increase in household income for those veterans affected by the policy change.

## 2. The Effect of the Agent Orange Decision on Disability Enrollment and Expenditures

Theoretically, one would expect the Agent Orange decision to increase the number of Vietnam veterans applying for DC benefits. As Parsons (1980), Bound (1989), and others have noted, the probability that an award will be made is a key determinant of an individual's decision to apply for disability benefits. An effect of the policy on the application decision is most plausible for those who were previously diagnosed with diabetes, but the policy may also have encouraged previously undiagnosed diabetics to request a medical checkup, which may have

led to the detection of diabetes or other health problems.<sup>4</sup> In addition, DC beneficiaries may be compensated for more than one disability, so the policy change also increased the incentive for existing DC recipients who served in Vietnam to apply for an increase in their monthly benefit.

If a DC award is made, the increase in DC benefits depends on the severity of diabetes, which is quantified using a disability rating scale ranging from 0 to 100 in increments of 10 percentage points. If a veteran is already receiving disability benefits, then the diabetes rating is combined with the ratings of the preexisting conditions to yield the combined disability rating (CDR).<sup>5</sup> If a veteran has only one disability, the rating of that disability is necessarily the CDR. The monthly DC benefit increases with the CDR, so the increase in DC benefits from diabetes depends on the change in the CDR due to an additional diabetes rating. The potential increase in monthly benefits for diabetes ranges from \$112 to \$2,393 per month in 2006.<sup>6</sup>

### 2.1. *Difference-in-Differences Estimates of the Impact on Disability Compensation Enrollment*

To estimate the impact of the policy change on DC enrollment, we employ VA administrative data, contained in the agency's *Annual Benefits Report* (Veterans Benefits Administration 1998–2008), on the number and characteristics of individuals receiving DC benefits at the end of the previous fiscal year. This information includes the number of DC recipients with certain diagnoses, the average monthly benefit received, and many other variables of interest. These data are further broken down by service era, although they do not distinguish between Vietnam-era veterans who served in Vietnam and those who did not.

We use a difference-in-differences strategy to estimate the impact of the policy change on enrollment. Intuitively, this strategy assumes that the change in DC enrollment among the affected population consists of two distinct and independent components: the direct effect of the policy and a systemic effect unrelated to the policy such as a change caused by macroeconomic conditions. The unrelated, systemic effect is estimated by first identifying a reasonable comparison

<sup>4</sup> According to a report by the Centers for Disease Control and Prevention (2003), approximately one-third of diabetics in the United States are undiagnosed. See Singleton (2009) for an analysis of self-reported rates of diagnosed diabetes among veterans and nonveterans in response to the Agent Orange decision.

<sup>5</sup> If a claimant has multiple disabilities, only the claimant's residual ability is considered when determining the impact of the next disability. For example, if a veteran has two disabilities rated at 50 percent, then only 50 percent of his ability is considered when determining the impact of the second disability. Therefore, his combined disability rating (CDR) would be 80 percent: the sum of 50 percent for the first disability and 25 percent for the second ( $.5 \times [1 - .5]$ ), rounded to the nearest increment of 10.

<sup>6</sup> If the CDR is greater than 30 percent, a veteran may receive additional benefits if he or she has a qualifying dependent spouse, children, or parents. The benefit can also increase for those who have ratings of 60 percent or more and who are deemed unemployable. For detailed information on the DC application and determination process as well as benefit determination, see Duggan, Rosenheck, and Singleton (2006).



group that is plausibly unaffected by the policy. The change in DC enrollment among this comparison group is the estimated systemic effect, which, when subtracted from the overall change in DC enrollment among the affected population, yields the estimated effect of the policy. The key assumption of this identification strategy is that the change in DC enrollment among the comparison and treatment groups would have been the same in the absence of the policy. Therefore, the reliability of the difference-in-differences estimator depends critically on the chosen comparison group.

Ideally, the treatment and comparison groups should be similar with respect to background characteristics such as age and education and should exhibit similar trends in DC enrollment shortly before the policy change. As mentioned above, we choose all Vietnam-era veterans as our treatment group, rather than only those who served in and around Vietnam, since the administrative data are not disaggregated by location of service within service eras. The remaining data are aggregated according to four service eras that define possible comparison groups: veterans from World War II, the Gulf War, the Korean War, and all peacetime eras. We choose peacetime veterans as the comparison group for two reasons. First, they exhibit trends in DC enrollment similar to those of Vietnam-era veterans prior to the policy change. Second, the mean age among peacetime veterans is very similar to that of Vietnam-era veterans, since most peacetime veterans served shortly before or after the Vietnam conflict. World War II and Gulf War veterans are not suitable comparison groups because their age distribution is so different from that of Vietnam veterans. And although Korean War veterans exhibit preexisting trends in DC enrollment similar to those of Vietnam-era veterans, the average age among Korean War veterans is considerably greater than that of Vietnam-era veterans.<sup>7</sup>

Figure 2 displays the fractions of Vietnam-era and peacetime veterans receiving DC benefits in September of each year from 1998 through 2008. As is clear from the figure, the trends for the two groups were fairly similar from 1998 to 2001, with the rate of enrollment increasing from 9.0 to 9.4 percent among Vietnam-era veterans and from 8.1 to 8.7 percent among peacetime veterans. The trend for the peacetime veterans was quite similar during the next 7 years, with 10.2 percent of them receiving DC benefits by the end of the 2008 fiscal year, an increase of 1.5 percentage points from the end of the previous period. But the increase in DC enrollment among Vietnam-era veterans was almost three times as large during this same 6-year period, with their enrollment rising by 4.2 percentage points, from 9.4 to 13.6 percent. Thus, our difference-in-differences estimate, which represents the effect of the Agent Orange decision on the change

<sup>7</sup> According to VetPop 2004, a population model maintained by the Veterans Administration (VA), the average ages of Korean War, Vietnam War, and peacetime veterans in September of 2002 were 72, 57, and 53, respectively.

in DC enrollment from September 2001 to September 2008, is 2.7 percentage points.<sup>8</sup>

Although the prepolicy trends in DC enrollment among Vietnam-era and peacetime veterans were similar, the increase for the latter group from 1998 to 2001 was actually slightly greater. If DC enrollment would have continued along its prepolicy trend in the absence of the policy, rather than following the post-policy trend of peacetime veterans assumed by the difference-in-differences estimator, then the estimated impact of the policy would be understated. As an alternative, we estimate the impact of the policy as the difference between actual DC enrollment in 2008 and the predicted rate of enrollment based on the pre-existing trend among Vietnam-era veterans, which yields a slightly greater estimate of 3.2 percentage points.<sup>9</sup>

Given that there were approximately 7.45 million Vietnam-era veterans alive in September 2008, our estimates suggest that the Agent Orange decision increased DC enrollment by between 201,000 and 238,000 above what it otherwise would have been. Since the policy applies only to the 3.6 million Vietnam-era veterans who served in Vietnam and the surrounding areas, the expanded eligibility criteria induced an increase in Vietnam veterans' DC enrollment of approximately 6 percentage points.

In addition to creating new beneficiaries, the policy may have increased the award amount among preexisting DC beneficiaries. To estimate the magnitude of this effect, in the first column of Table 1 we list the number of new DC awards to recipients with an endocrine-system disorder (typically diabetes) as a covered condition in each year from 1998 to 2006. In the second column we list the number of DC recipients at the end of the year with this same type of condition covered. The difference between the increase in the stock of recipients with an endocrine disorder and the flow of new recipients with this condition is our measure of the number of preexisting beneficiaries who qualified for an increase in DC benefits.

Consider as an example the change from 2000 to 2001, when the number of DC recipients with an endocrine-system condition increased by 9,321, whereas the number of new awards to recipients with this condition was just 5,913. Thus we estimate that at least 3,408 existing DC recipients received an increase in their benefit, as shown in the third column. The actual number is presumably somewhat larger, as some of those in the program at the end of 2000 would have left the program by 2001. To adjust for this, we inflate our estimates in column 3 by 1,341 in each year, the average number leaving in the 2 previous

<sup>8</sup> This is equal to the difference between the increases from 2001 to 2008 of 4.2 and 1.5 percentage points. This estimate and the one in the next paragraph are almost identical if we instead use 2000 as the baseline.

<sup>9</sup> The actual increase in DC enrollment among Vietnam-era veterans from 2001 to 2008 exceeded the increase one would have expected based on the pre-2001 trend by 3.2 percentage points (13.6 versus 10.4 percent). The corresponding difference for peacetime veterans was just .2 percent (10.2 versus 10.0 percent).

Table 1  
Recipients of Disability Compensation (DC) Affected by the Agent Orange Decision

Year	Endocrine-System Disorder		Discrepancy		Endocrine Condition	
	New Awards	End-of-Year Recipients	Unadjusted	Adjusted	Diabetes	Other
1998	2,350	56,416				
1999	2,501	57,576	-1,341	0	37,808	19,768
2000	2,485	58,719	-1,342	-1	37,985	20,734
2001	5,913	68,040	3,408	4,749	46,395	21,645
2002	39,852	134,905	27,013	28,354	111,932	22,973
2003	36,897	185,908	14,106	15,447	161,551	24,357
2004	26,206	217,126	5,012	6,353	191,649	25,477
2005	26,274	247,324	3,924	5,265	220,532	26,792
2006	25,457	276,094	3,313	4,654	247,992	28,102
Total				64,821		

Source. Veterans Benefits Administration (1998–2008).

Note. The data in the third column equal the number of recipients in year  $t$  (second column year  $t$ ) minus the sum of the number at the end of the previous year (second column year  $t - 1$ ) and the number of new awards (first column year  $t$ ), with the fourth column simply adding 1,341 to this number to account for the estimated exit that would have occurred. The total of the fourth column indicates the number of DC recipients who experienced an increase in their monthly benefit because of the policy change by the end of 2006. Of the 247,992 with diabetes in September 2006, more than 215,000 are from the Vietnam era.

years, as shown in the two preceding rows. With this adjustment, we estimate that by the end of 2006 (the most recent year with diagnosis data) approximately 65,000 DC recipients experienced an increase in their monthly benefit because of the policy change.<sup>10</sup>

Taken together, our estimates in this section suggest that between 265,000 and 300,000 Vietnam veterans, who represent 7.4 to 8.3 percent of all those who served in the Vietnam theater during the war, became newly eligible for DC benefits or experienced an increase in their monthly benefit as a result of the 2001 Agent Orange decision.

## 2.2. *The Impact of the Agent Orange Decision on Disability Compensation Expenditures*

To estimate the impact of the policy on DC expenditures, we use administrative data and an identification strategy similar to those used in Section 2.1 on DC enrollment. The data, provided in Table 2, indicate that total monthly benefit increased considerably among Vietnam-era veterans after the policy change compared to peacetime veterans. To estimate the effect of this change on program expenditures, we estimate what aggregate DC benefits for Vietnam-era veterans would have been in September 2007 if the prepolicy expenditure trend had continued. Our projection for monthly DC spending on Vietnam-era veterans in 2007 is \$238 million lower than actual spending. The corresponding projection

<sup>10</sup> By September 2006, 21.9 percent of Vietnam-era veterans in the DC program had diabetes as a covered condition versus 1.8 percent of all other DC recipients.

Table 2  
Monthly Disability Compensation (DC) Expenditures, September 1998 to September 2007

Year	Vietnam Era		Peacetime		All Service Eras	
	DC Spending (\$1,000s)	Increase (%)	DC Spending (\$1,000s)	Increase (%)	DC Spending (\$1,000s)	Increase (%)
1998	435,984	6.86	231,904	6.70	1,101,300	5.31
1999	464,885	6.63	246,384	6.24	1,158,548	5.20
2000	499,453	7.44	262,879	6.69	1,231,115	6.26
2001	542,045	8.53	279,511	6.33	1,317,185	6.99
2002	624,907	15.29	300,815	7.62	1,465,761	11.28
2003	716,975	14.73	322,295	7.14	1,627,995	11.07
2004	802,545	11.93	341,046	5.82	1,781,844	9.45
2005	891,052	11.03	361,381	5.96	1,953,622	9.64
2006	979,868	9.97	383,190	6.03	2,135,238	9.30
2007	1,075,429	9.75	406,944	6.20	2,344,595	9.80
Projected 2007	837,847		406,051		1,884,209	
Actual – projected 2007	237,582	[28.36]	893	[.22]	460,386	[24.43]

Source. Veterans Benefits Administration (1998–2008).

Note. The DC expenditure amounts represent the awards to veterans in September of each year. The percentage of increase represents the percentage change from the previous year to the current year. Projections for 2007 assume that the growth rate from 1998 to 2001 would have continued for the next 6 years. Values in square brackets are percentage differences.

for peacetime veterans is almost identical to the actual level of expenditures in 2007, with a difference of less than \$1 million. This result suggests that the Agent Orange decision increased annual spending by \$2.85 billion, which accounts for 52 percent of the acceleration in overall DC spending from 2001 to 2007.<sup>11</sup> Given our estimate that 240,000 Vietnam veterans were affected by the policy by September 2007, this suggests that the average increase in transfer income for affected veterans was approximately \$1,000 per month.<sup>12</sup>

We also rely on simplified calculations to estimate the impact of the policy on long-run expenditures. First, for the 2002 to 2006 fiscal years, we simply linearly interpolate the 2007 estimate. This would, for example, assume that 50 percent of the \$2.85 billion expenditure effect had occurred by 2004. For future years, we deflate the 2007 estimate by the VA's estimated decline in the Vietnam-era-veteran population. For example, the VA estimates that the number of Vietnam-era veterans will decline by 17.5 percent from 2007 to 2017, and we therefore assume an expenditure effect of \$2.35 billion in 2017.<sup>13</sup> Using this algorithm along with an annual real discount rate of 3 percent, we estimate that the present value of DC spending increased by more than \$50 billion (in 2007 dollars) as a result of the expanded medical eligibility criteria.<sup>14</sup>

<sup>11</sup> Table 2 shows that the difference between actual and projected total monthly DC spending was \$460 million.

<sup>12</sup> The number of affected veterans considered is slightly lower than that estimated in Section 2.1 using data through 2008, given that the most recent year of DC expenditure data available is 2007.

<sup>13</sup> The VA indexes DC benefits to the consumer price index, and thus we do not scale for the effect of inflation.

<sup>14</sup> This estimate may overestimate the impact if newly compensated veterans have shorter life expectancies than other Vietnam-era veterans. However, it seems more likely that our estimates underestimate the effect, since we do not include additional spending of the Veterans Health Administration or take into account the continued effect of the policy on DC enrollment.

### 3. The Impact on Vietnam Veterans—Evidence from the Veterans Supplement to the Current Population Survey

According to Section 2.2, the Agent Orange policy significantly increased DC enrollment and cash benefits received by Vietnam-era veterans. In this section, we estimate the effect of the Agent Orange decision on several outcome variables of interest using data from the Veterans Supplements to the Current Population Survey of the Bureau of Labor Statistics. In contrast to administrative data, these data allow us to distinguish Vietnam-era veterans who actually served in or around Vietnam from those who did not. Thus, for the CPS data analysis, we define the former as the treatment group and the latter as the comparison group. We use data from every odd-numbered year between 1997 and 2005 since Veterans Supplement data are collected every 2 years. Because the 2001 survey was conducted in August, just 1 month after the policy change, 2001 data are assigned to the prepolicy period.

#### 3.1. Constructing the Analysis Sample

We restrict the analysis sample to male Vietnam-era veterans born between 1938 and 1954. According to Veterans Supplement data in 1997, 1999, and 2001, more than 97 percent of self-reported Vietnam-era veterans are male and more than 86 percent of Vietnam-era veterans were born in or between 1938 and 1954. According to the data, more than one out of every four men born between 1938 and 1954 is a Vietnam-era veteran. The fraction of men who are Vietnam-era veterans exceeds 10 percent for all 17 of these year-of-birth cohorts—peaking at more than 40 percent for the 1946 to 1948 birth cohorts—whereas men born before 1938 or after 1954 are much less likely to be Vietnam-era veterans.<sup>15</sup> Approximately half of Vietnam-era veterans born between 1938 and 1954 actually served in or around Vietnam.

We present summary statistics of the analysis sample for the prepolicy period (1997–2001) in Table 3. The average characteristics of Vietnam veterans who served in or around Vietnam and those who did not are similar but by no means identical. Two notable differences are that those who actually served in Vietnam are significantly more likely to report a VA-rated disability and are somewhat more likely to be out of the labor force. They are also more likely to be black and less likely to have attended and graduated from a 4-year college.

We next examine the characteristics of DC recipients just prior to the policy change. Table 4 provides information on the average characteristics of veteran males born between 1938 and 1954 who report that they have a VA-rated disability. The last five columns separate observations into one of five disability rating categories contained in the CPS.

An examination of the labor force nonparticipation figures reveals that the

<sup>15</sup> Recall that the Vietnam service era includes the years 1964–74. Thus, a person who served from 1956 to 1965 is labeled a Vietnam-era veteran because his period of service overlapped with the Vietnam era.

Table 3  
Descriptive Statistics by Veteran Service Status

	Vietnam Veterans	Other Vietnam-Era Veterans
<i>N</i>	4,756	4,958
Married	74.7	77.2
Age	52.1	52.1
White	88.0	90.1
Black	10.1	8.1
Other	1.8	1.8
Less than high school	5.1	4.8
High school	33.4	31.3
Some college	36.0	33.5
College and beyond	25.5	30.4
LFNP	16.5	14.0
LFNP, disabled	7.6	5.6
Work disabled	7.6	5.7
VA disability	17.5	6.9

**Note.** All values except for the number of observations are percentages. The analysis sample is pooled 1997, 1999, and 2001 Current Population Survey Veterans Supplements, restricted to male Vietnam-era veterans born between 1938 and 1954. There are three missing values for “work disabled” among the entire sample and 1,039 missing values for “VA disability”; the statistics are conditional on nonmissing values. Among the 1,041 veterans who report having a Veterans Administration (VA) disability, 963 report a VA service-connected disability rating. Veteran sample weights were used. LFNP = labor force nonparticipation.

fraction of DC recipients who are out of the labor force is generally increasing with the CDR. For example, while 14.5 percent of those with a rating of 1–10 percent are out of the labor force, 25 percent of those with an 11–29 percent rating and 43 percent of those with a 51–99 percent rating are out of the labor force. Among those with an 11–29 percent rating who are out of the labor force, just 29 percent ( $= .071/.249$ ) report that this is because of a disability. This fraction increases with the CDR, to 52 percent for those with a CDR of 30–50 percent, 60 percent for those with a CDR of 51–99 percent, reaching a maximum of 75 percent for those with the maximum CDR of 100 percent. However, it is unclear whether this negative association between the CDR and labor supply reflects the effect of increasingly severe disabilities or the causal effect of the associated increases in DC benefits.

### 3.2 *Difference-in-Differences Estimates of the Impact of the Disability Compensation Program*

We first investigate whether there was a differential increase in DC enrollment among Vietnam veterans relative to other Vietnam-era veterans who did not serve in or around Vietnam. Table 5 contains two different measures of DC enrollment by Vietnam veteran status in survey years 1997, 2001, and 2005. The first is the percentage of veterans who report having a CDR greater than 10 percent, and the second is the percentage of veterans who report having a CDR greater than 50 percent.

Table 4  
Summary Statistics for Veterans with a Rated Disability, by Rating

	VA Disability Status										
	None	Disability	Service-Connected Disability Rating							Combined Disability Rating (CDR)	
			1,221	1,123	0	1-10	11-29	30-50	51-99	100	
N	10,207	1,221	1,123	97	350	152	263	115	146		
Married	77.5	72.0	72.6	77.2	77.4	68.3	74.2	77.0	56.7		
Age	53.0	52.4	52.5	52.5	52.6	52.5	52.0	52.8	52.6		
White	90.4	84.1	84.1	89.5	86.3	78.7	84.2	77.3	85.8		
Black	8.0	12.1	12.1	7.0	10.6	14.3	12.8	17.3	11.4		
Other	1.6	3.7	3.8	3.6	3.0	7.0	3.0	5.4	2.7		
Less than high school	5.7	6.4	6.0	2.6	5.1	4.8	5.1	7.8	11.3		
High school	34.1	26.4	25.6	28.8	22.8	19.4	23.7	31.0	35.3		
Some college	33.1	38.8	39.5	42.5	38.7	42.3	40.3	37.6	36.6		
College and beyond	27.1	28.5	28.9	26.1	33.4	33.4	30.9	23.5	16.8		
LFPN	14.7	31.8	32.0	19.7	14.5	24.9	24.4	43.2	91.5		
LFPN, disabled	5.3	17.5	17.3	3.8	3.6	7.1	12.8	26.1	68.7		
Work disabled	5.3	17.4	17.3	3.8	3.6	7.1	12.8	26.1	68.7		
VA payment		81.2	82.8	1.4	82.5	90.9	92.0	96.8	97.3		
VA ever prevented work		31.5	31.8	7.8	10.5	32.4	33.1	50.0	80.0		

Note. All values except for the number of observations are percentages. The analysis sample is pooled 1997, 1999, and 2001 Current Population Survey Veterans Supplements, restricted to male Vietnam-era veterans born between 1938 and 1954. Among the 1,123 veterans with a Veterans Administration (VA) service-connected disability rating, there was one missing value for "work disabled," 11 missing values for "VA payment" (only available for 1997 and 1999), and nine missing values for "VA ever prevented work." A CDR of zero occurs when the VA evaluates a disability but assigns it a zero rating. Disabilities with a zero rating are referred to as "noncompensable zeros." In some cases, multiple noncompensable zeros will result in a CDR of 10; in other cases, the CDR remains zero. Veteran sample weights were used. LFPN = labor force nonparticipant.

Table 5  
Disability Compensation Rating and Labor Force Nonparticipation (LFNP)  
by Vietnam-Era Service Status

Year	CDR > 10		CDR > 50		LFNP	
	Other VEVs	Vietnam Veterans	Other VEVs	Vietnam Veterans	Other VEVs	Vietnam Veterans
1997	3.1 (.5)	10.6 (.9)	1.4 (.3)	5.4 (.6)	10.5 (.8)	12.0 (.9)
2001	3.7 (.5)	10.1 (.8)	1.8 (.3)	5.1 (.6)	18.4 (1.0)	20.0 (1.0)
2005	3.5 (.5)	14.1 (1.0)	1.7 (.3)	9.3 (.8)	28.0 (1.1)	29.7 (1.3)
Difference:						
2001 - 1997	.5 (.7)	-.4 (1.2)	.4 (.5)	-.3 (.8)	7.9 (1.3)	8.1 (1.4)
2005 - 2001	-.2 (.7)	3.9 (1.2)	-.1 (.5)	4.2 (1.0)	9.6 (1.5)	9.7 (1.6)

Note. Values presented are percentages. The analysis sample is pooled 1997, 1999, 2001, 2003, and 2005 Current Population Survey Veterans Supplements, restricted to male Vietnam-era veterans born between 1938 and 1954. There are missing values for the some observations among the full sample. To keep the sample consistent across outcomes, the sample here contains only observations with all relevant information. Veteran sample weights were used. Standard errors are in parentheses. CDR = combined disability rating; VEVs = Vietnam-era veterans.

As the table shows, prior to the policy change, DC enrollment was substantially higher among Vietnam veterans compared to their Vietnam-era veteran counterparts. For example, in August 2001, 10.1 percent of Vietnam veterans reported that they were receiving DC benefits and had a CDR greater than 10 percent, compared to just 3.7 percent of Vietnam-era veterans who did not serve in or around Vietnam. Despite the differences in levels, the differential increase in DC enrollment was very similar between the two groups prior to the policy, changing by .5 and  $-.4$  percentage points among Vietnam veterans and other Vietnam-era veterans, respectively. However, during the next 4 years, DC enrollment among Vietnam veterans increased substantially, with the fraction having a CDR greater than 10 percent increasing from 10.1 to 14.1 percent. In contrast, there was a slight decline for other Vietnam-era veterans.

Using a difference-in-differences estimator, we estimate that the policy increased the fraction of Vietnam veterans with a CDR greater than 10 percent by more than 4.1 percentage points, which is qualitatively similar to the previous estimate using administrative data.<sup>16</sup> Using the same estimator, the policy increased the fraction of Vietnam veterans with a CDR greater than 50 percent by 4.3 percentage points.

We next consider various reduced-form effects of the policy. The first effect

<sup>16</sup> Recall our estimate of a 2.7-percentage-point increase among Vietnam-era veterans by September 2007. Given that 47 percent of these veterans were affected by the policy, the implied estimate for Vietnam veterans would be 5.7 percentage points. And given that the CPS estimate is 4 years after the policy instead of 6, one would expect the estimate to be one-third lower, approximately 3.8 percentage points.



is the impact on labor supply among Vietnam veterans. Table 5 also provides labor force nonparticipation figures by Vietnam-era veteran status. Similar to DC receipt, there are differences of level in labor force nonparticipation prior to the policy—Vietnam veterans are slightly more likely to be out of the labor force—but the change from 1997 to 2001 is almost identical for the two groups. However, in contrast to the growth in DC receipt, the change in labor force nonparticipation is nearly identical between the two groups after the policy.

The raw data suggest that the increase in DC receipt did not increase labor force exit among Vietnam veterans. However, these unconditional changes could mask important changes in the composition of the two groups. To account for this, we estimate a linear probability model with the following form:

$$Y_{jt} = \mu + \lambda \times X_{jt} + \gamma_1 \times VV_{jt} + \gamma_2 \times VV_{jt} \\ \times (t - 2001) \times I(t > 2001) + \sum_{t=1997}^{2005} \theta_t + \varepsilon_{jt}$$

where  $j$  and  $t$  index individuals and years, respectively. The vector  $X_{jt}$  includes a set of background characteristics including indicator variables for the veteran's race and education along with his age and age squared. The vector  $\theta$  represents a set of five indicator variables for each year of the survey, which are included to control for common changes in the outcome variable of interest,  $Y_{jt}$ , over time.

The variable  $VV_{jt}$  is equal to one if Vietnam-era veteran  $j$  in survey year  $t$  reports that he served in Vietnam during the conflict there, and zero otherwise. This variable is included to control for baseline differences between the treatment and comparison groups. To determine whether the outcome variable changed differentially for those directly affected by the policy, it is interacted with a variable that is equal to the number of years after the policy (2 in 2003, 4 in 2005, and 0 otherwise). We use the differential-trend specification since the increase in DC enrollment was not instantaneous but rather close to linear over time; our results are qualitatively similar if we instead interact with just a post-policy indicator. The parameter of particular interest in this equation is  $\gamma_2$ , which captures the average differential change in  $Y$  for the treatment group, after controlling for background characteristics, in the years following the policy change.

The results from several specifications are summarized in Table 6. Consistent with the raw data displayed in Table 5, columns 1 and 2 demonstrate that there is a substantial increase in the probability of DC enrollment among veterans who actually served in Vietnam. The estimated impact by 2005 (calculated by multiplying the coefficient estimate for  $\gamma_2$  by 4) is 3.5 percentage points for veterans with CDRs greater than 10 and 4.2 percentage points for veterans with CDRs greater than 50. Both estimates are statistically significant at the 1 percent level.

In addition to Vietnam veteran service status, we considered another de-

Table 6  
First-Stage and Reduced-Form Effects of the Agent Orange Policy

Dependent Variable	DC Receipt		LFNP	Disabled	Household Income $\geq$	
	CDR > 10	CDR > 50			\$60,000	Married
Sample mean	7.20	3.84	19.34	7.19	44.98	76.56
Vietnam veteran	6.69** (.63)	3.39** (.46)	2.67** (.86)	1.72** (.59)	-2.65* (1.17)	-1.94+ (1.01)
Posttrend $\times$ Vietnam veteran	.87** (.33)	1.04** (.26)	-.06 (.48)	-.02 (.32)	.71 (.60)	.48 (.51)
N	14,414	14,414	14,414	14,411	12,958	14,414

Note. The analysis sample is pooled 1997, 1999, 2001, 2003, and 2005 Current Population Survey Veterans Supplements, restricted to male Vietnam-era veterans born between 1938 and 1954. There are missing values for some observations among the full sample. To keep the sample consistent across outcomes, observations were deleted if the rated status or the rating itself was missing. This criterion reduces the sample from 16,514 to 14,414 observations. Among the 14,414 observations, 1,456 observations were missing household income data. Regressions include controls for educational attainment (less than high school, some college, and college graduate relative to high school graduate), race (white and other relative to black), year (1999, 2001, 2003, and 2005 relative to 1997), and age (age and age squared). Estimates are factored by 100 and are therefore interpreted as percentage-point changes. Veteran sample weights were used. Robust standard errors are in parentheses. CDR = combined disability rating.

+  $p < .10$ .

\*  $p < .05$ .

\*\*  $p < .01$ .

mographic factor to further identify the treatment group: year of birth. Agent Orange was first used in Vietnam in 1965, so the presumption clause is more relevant for Vietnam veterans from younger birth cohorts, who were more likely to be exposed to herbicides. We divided the analysis sample into older and younger birth cohorts—1938–45 and 1946–54—and found that much of the rise in DC receipt (measured as CDR > 10) after the policy was implemented is concentrated among younger birth cohorts: the rate increased by 1.2 percentage points per year among younger veterans, compared to a statistically insignificant .2 percentage points among Vietnam veterans from older cohorts (results not shown).<sup>17</sup>

Table 6 also explores the effect on labor supply, self-reported health status, and household income. The statistically insignificant point estimate of  $-.06$  for  $\gamma_2$  in the LFNP specification suggests that the policy change did not reduce the labor supply of affected veterans. However, the standard error of this point estimate is substantial, and thus we cannot rule out a wide range of labor-supply effects. The finding for health status as measured by self-reported disability is similar, and our estimate for  $\gamma_2$  is a statistically insignificant  $-.02$ . This estimate

<sup>17</sup> We also considered race to further identify those affected by the policy: among males born between 1944 and 1950 (controlling for educational attainment, veteran status, and age), blacks are 6.7 percentage points more likely to be diabetic during the years 1997 and 2006 (Singleton 2009). Among black Vietnam-era veterans, we found that DC enrollment differentially increased by 2 percentage points per year for those who served in or around Vietnam—compared to the baseline estimate of 1 percentage point—though the difference was not statistically significant.

Table 7  
 Linear Probability Models of Disability Compensation (DC) Receipt  
 and Labor Supply: Married Veterans and Their Wives

Dependent Variable	DC Receipt		Husband		Wife	
	CDR > 10	CDR > 50	LFNP	Hours Worked	LFNP	Hours Worked
Mean	6.1	2.9	19.2	34.7	30.8	25.5
Vietnam veteran	5.46** (.89)	2.55** (.62)	2.43* (1.21)	.15 (.67)	-.44 (1.44)	.31 (.67)
Posttrend × Vietnam veteran	1.16** (.43)	1.15** (.32)	-.27 (.55)	-.28 (.30)	1.11+ (.65)	-.56+ (.30)
N	6,913	6,913	6,913	5,863	6,913	5,863

**Note.** The analysis sample is pooled 1997, 1999, 2001, 2003, and 2005 Current Population Survey Veterans Supplements, restricted to married male Vietnam-era veterans born between 1938 and 1954 whose wives were also born between 1938 and 1954. There are missing values for some observations among the full sample. To keep the sample consistent across outcomes, observations were deleted if the rated status or the rating itself was missing. This criterion reduces the sample from 7,914 to 6,913 observations. The DC receipt regressions include controls for educational attainment (less than high school, some college, and college graduate relative to high school graduate), race (white and other relative to black), year (1999, 2001, 2003, and 2005 relative to 1997), and age (age and age squared). For the labor-supply models, we allow the error terms to be correlated within couples using seemingly unrelated regressions. The sample size is reduced for the Hours Worked specification because of missing values for the husband, wife, or both. Estimates are factored by 100 and are therefore interpreted as percentage-point changes. Veterans sample weights were used. Robust standard errors are in parentheses. CDR = combined disability rating; LFNP = labor force nonparticipation.

+  $p < .10$ .

\*  $p < .05$ .

\*\*  $p < .01$ .

is smaller than the corresponding estimates for DC enrollment in the CDR specifications by more than an order of magnitude.

The next specification considers the effect of the policy on economic well-being as measured by household income. The outcome variable is equal to one if household income exceeds \$60,000 and is zero otherwise.<sup>18</sup> Although the point estimate of .71 for  $\gamma_2$  is statistically insignificant, it is similar in magnitude to the corresponding estimate for DC enrollment, suggesting a 3-percentage-point increase in the fraction of households with incomes above this range by August 2005.

Previous research has emphasized that transfer income can have an effect on the labor supply of a person's spouse (Cullen and Gruber 2000). To consider this issue, in Table 7 we report the results from specifications in which we focus only on married veterans.<sup>19</sup> We further restrict attention to those whose wives

<sup>18</sup> The Veterans Supplement unfortunately only measures income in categories. The extent to which the fraction in each income category rises over time (for example, because of inflation) should be captured by the year effects.

<sup>19</sup> One concern with conditioning the sample on married Vietnam veterans is that the policy may have affected marriage strategies. However, using the sample of all Vietnam veterans, we find that estimates from a linear probability model suggest that there was no statistically significant change in the probability of marriage among Vietnam veterans relative to other Vietnam-era veterans after the policy was implemented.

were also born between 1938 and 1954. These two restrictions reduce our sample size by approximately half, to 6,913 married couples.

The results of specifications analogous to those in Table 6 are reported in Table 7. We find slightly larger effects of the policy on DC enrollment among married Vietnam veterans, though once again we find little evidence for an effect on labor supply. However, when we investigate the effect of the policy on both labor force nonparticipation and hours worked among the wives of Vietnam veterans, we detect a statistically significant increase in the probability that the wives are out of the labor force and a significant decline in hours worked.<sup>20</sup> This suggests that there may be important labor-supply effects of this policy, with at least part of the effect arising through wives who reduce their work effort.

#### 4. Discussion

Virtually all of the prior literature on disability insurance programs has focused on the Social Security Disability Insurance and Supplemental Security Income programs, with almost no consideration of the U.S. Department of Veterans Affairs' Disability Compensation program. In this paper, we briefly describe the key features of the DC program and estimate its effect on the health, labor supply, and economic well-being of beneficiaries. The response to DC benefit generosity is identified by a recent and unique policy change that deemed diabetes a service-connected disability for Vietnam veterans. To the best of our knowledge, this is the only significant change to a federal disability program in the United States that has applied to one group of adults but not others.

Using administrative data from the VA, we estimate that the policy increased disability enrollment among Vietnam veterans by approximately 6 percentage points and increased the monthly benefit amount for an additional 1.7 percent of Vietnam veterans. We further estimate that the policy increased DC expenditures by \$2.85 billion in the 2007 fiscal year and by \$50 billion in present-value terms. Using microlevel data from the Veterans Supplement to the Current Population Survey, we find no measurable effect of increased benefit receipt on the health or labor supply of Vietnam veterans, but we do detect a small decline in labor supply and hours worked among their wives. However, there were just 14,000 Vietnam-era veterans in our analysis sample constructed from CPS data, so additional research with better data is clearly warranted.

What do these findings imply for other disability programs, such as SSDI and SSI? Because only Vietnam veterans were directly affected by this policy change, one cannot assume that a similar change for those programs would have the same response. In addition, because the DC program is quite different from SSDI and SSI, which pay benefits on an all-or-nothing basis and do not allow recipients to have significant earnings, the effect of such a change in these other

<sup>20</sup> The labor-supply equations were estimated using seemingly unrelated regressions at the couple level, which permits correlation in the error terms of the labor-supply equations within couples.

programs might be quite different (Autor and Duggan 2007). However, the findings do demonstrate that a relatively narrow change in the medical eligibility criteria for the DC program led to an increase in disability benefits for approximately 8 percent of the individuals potentially affected by the policy. This makes it more plausible that the 1984 reforms to SSDI and SSI, which substantially expanded the medical eligibility criteria for these programs, could have caused much of the increase in enrollment for both programs during the past 2 decades.

The VA's DC program is a large and rapidly growing program that has been essentially ignored in prior economic research. At present, 13 percent of military veterans are receiving DC benefits, with \$31 billion paid to them in cash benefits during the 2008 fiscal year. Thus, more work on the DC program, an increasingly important source of income and insurance for the nation's military veterans and their family members, seems warranted.

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